AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (original) A method for generating a modulation wave instruction of the PWM inverter apparatus, which is controlled by a pulse width modulation signal obtained by comparing a modulation wave signal of a voltage instruction with a carrier wave,

the method comprising the steps of:

providing an upper limit value of modulation wave, which is equal to or smaller than the maximum value of the carrier wave and larger than the minimum value of the carrier wave; and

correcting the modulation wave instructions of a plurality of phases so that the modulation wave instructions become between the minimum value of the carrier wave and the upper limit value of the modulation wave.

2. (original) The method for generating a modulation wave instruction of the PWM inverter apparatus as in claim 1, wherein

the modulation wave instructions are corrected to become between the minimum value of the carrier wave and the upper limit value of the modulation wave, after the modulation wave instruction of the plurality of phases is reduced by a difference between the maximum value of the carrier wave and the upper limit value of the modulation wave.

3. (original) The method for generating a modulation wave instruction of the PWM inverter apparatus as in claim 2, wherein

the modulation wave instructions of the plurality of phases are corrected so that a difference between the maximum value and the minimum value of the modulation wave instructions coincides with the difference between the minimum value of the carrier wave and the upper limit value of the modulation wave and so that a modulation ratio instruction

coincides with an actual modulation ratio until all of the modulation wave instructions of the plurality of phases become the maximum value or the minimum value.

4. (currently amended) The method for generating a modulation wave instruction of the PWM inverter apparatus including a charge pump circuit for charging a capacitor with pulse of a negative side switching device as a drive circuit power source of a switching device, as in claim 1 ~~any of claims 1 to 3~~, wherein

the upper limit value of the modulation wave is determined so that the pulse width of the negative side switching device at a frequency of the carrier wave becomes a pulse width necessary to maintain an output voltage of the charge pump circuit.

5. (original) The method for generating a modulation wave instruction of the PWM inverter apparatus as in claim 4, wherein

the upper limit value of the modulation wave has an initial value, when an output frequency is 0;

increases monotonously from the initial value with increase of the output frequency;

is limited to an upper limit of a minimum pulse width, when it exceeds the upper limit of the minimum pulse width required by a switching device; and

is changed so that it coincides with the maximum value of the carrier wave, when the output frequency becomes high.

6. (currently amended) A method for generating a modulation wave instruction of the PWM inverter apparatus as in claim 1 ~~any of claims 1 to 3~~, wherein

the output phase currents of the plurality of phases are detected between the negative side switching devices and the negative side of the D.C. power source; and

the upper limit value of the modulation wave is determined so that the pulse width of the negative side switching device is maintained for a time long enough to detect the currents.

7. (original) A motor control apparatus comprising:

a voltage instruction producing unit for producing a voltage instruction on the basis of a current detection value and a current instruction;

a modulation wave instruction producing unit for producing a modulation wave instruction on the basis of the voltage instruction;

a PWM signal generator unit for generating a PWM signal obtained by comparing the modulation wave instruction with a carrier wave; and

a PWM inverter apparatus controlled by the PWM signal;

a modulation wave upper limit value calculation unit for calculating an upper limit value of modulation wave so that the upper limit value of modulation wave becomes equal to or smaller than the maximum value of the carrier wave and larger than the minimum value of the carrier wave; and

a modulating wave control unit for correcting the modulation wave instruction to be a value between the upper limit value of modulation wave and the minimum value of the carrier wave.

8. (original) The motor control apparatus as in claim 7, wherein

the modulation wave control unit corrects the modulation wave instruction to be a value between the upper limit value of the modulation wave and the minimum value of the carrier wave, after the modulation wave instruction is reduced by a difference between the maximum value of the carrier wave and the upper limit value of the modulation wave.

9. (original) The motor control apparatus as in claim 8, wherein

the modulation wave control unit adds an overmodulation correction for making a modulation ratio instruction coincident with an actual modulation ratio to the modulation wave instruction.

10. (currently amended) A motor control apparatus as in claim 7 ~~any of claims 7 to 9~~, comprising:

a charge pump circuit for obtaining a power source of a switching device drive circuit of the PWM inverter by charging a capacitor with a pulse of a negative side switching device; and

a current detection unit for detecting the output phase currents of the plurality of phases between the negative side switching devices and the negative side of the D.C. power source, wherein

the modulating wave upper limit value calculation unit calculates the upper limit value of modulating wave on the basis of a pulse width required for a switching device to be used, a pulse width required for maintaining an output voltage of the charge pump circuit or a pulse width required for current detection.

11. (original) The motor control apparatus as in claim 10, wherein

the modulation wave upper limit value calculation unit calculates the upper limit value of modulation wave so that the upper limit value of the modulation wave has an initial value, when an output frequency is 0;

increases monotonously from the initial value with increase of the output frequency;

is limited to an upper limit of a minimum pulse width when it exceeds the upper limit of the minimum pulse width required by a switching device; and

is changed so that it coincides with the maximum value of the carrier wave, when the output frequency becomes high.

12. (new) The method for generating a modulation wave instruction of the PWM inverter apparatus including a charge pump circuit for charging a capacitor with pulse of a negative side switching device as a drive circuit power source of a switching device, as in claim 2, wherein

the upper limit value of the modulation wave is determined so that the pulse width of the negative side switching device at a frequency of the carrier wave becomes a pulse width necessary to maintain an output voltage of the charge pump circuit.

13. (new)The method for generating a modulation wave instruction of the PWM inverter apparatus including a charge pump circuit for charging a capacitor with pulse of a negative side switching device as a drive circuit power source of a switching device, as in claim 3, wherein

the upper limit value of the modulation wave is determined so that the pulse width of the negative side switching device at a frequency of the carrier wave becomes a pulse width necessary to maintain an output voltage of the charge pump circuit.

14. (new) The method for generating a modulation wave instruction of the PWM inverter apparatus as in claim 12, wherein

the upper limit value of the modulation wave has an initial value, when an output frequency is 0;

increases monotonously from the initial value with increase of the output frequency;

is limited to an upper limit of a minimum pulse width, when it exceeds the upper limit of the minimum pulse width required by a switching device; and

is changed so that it coincides with the maximum value of the carrier wave, when the output frequency becomes high.

15. (new) The method for generating a modulation wave instruction of the PWM inverter apparatus as in claim 13, wherein

the upper limit value of the modulation wave has an initial value, when an output frequency is 0;

increases monotonously from the initial value with increase of the output frequency;

is limited to an upper limit of a minimum pulse width, when it exceeds the upper limit of the minimum pulse width required by a switching device; and

is changed so that it coincides with the maximum value of the carrier wave, when the output frequency becomes high.

16. (new) A method for generating a modulation wave instruction of the PWM inverter apparatus as in claim 2, wherein

the output phase currents of the plurality of phases are detected between the negative side switching devices and the negative side of the D.C. power source; and

the upper limit value of the modulation wave is determined so that the pulse width of the negative side switching device is maintained for a time long enough to detect the currents.

17. (new) A method for generating a modulation wave instruction of the PWM inverter apparatus as in claim 3, wherein

the output phase currents of the plurality of phases are detected between the negative side switching devices and the negative side of the D.C. power source; and

the upper limit value of the modulation wave is determined so that the pulse width of the negative side switching device is maintained for a time long enough to detect the currents.

18. (new) A motor control apparatus as in claim 8, comprising:

a charge pump circuit for obtaining a power source of a switching device drive circuit of the PWM inverter by charging a capacitor with a pulse of a negative side switching device; and

a current detection unit for detecting the output phase currents of the plurality of phases between the negative side switching devices and the negative side of the D.C. power source, wherein

the modulating wave upper limit value calculation unit calculates the upper limit value of modulating wave on the basis of a pulse width required for a switching device to be used, a pulse width required for maintaining an output voltage of the charge pump circuit or a pulse width required for current detection.

19. (new) A motor control apparatus as in claim 9, comprising:

a charge pump circuit for obtaining a power source of a switching device drive circuit of the PWM inverter by charging a capacitor with a pulse of a negative side switching device; and

a current detection unit for detecting the output phase currents of the plurality of phases between the negative side switching devices and the negative side of the D.C. power source, wherein

the modulating wave upper limit value calculation unit calculates the upper limit value of modulating wave on the basis of a pulse width required for a switching device to be used, a pulse width required for maintaining an output voltage of the charge pump circuit or a pulse width required for current detection.

20. (new) The motor control apparatus as in claim 18, wherein

the modulation wave upper limit value calculation unit calculates the upper limit value of modulation wave so that the upper limit value of the modulation wave has an initial value, when an output frequency is 0;

increases monotonously from the initial value with increase of the output frequency;

is limited to an upper limit of a minimum pulse width when it exceeds the upper limit of the minimum pulse width required by a switching device; and

is changed so that it coincides with the maximum value of the carrier wave, when the output frequency becomes high.

21. (new) The motor control apparatus as in claim 19, wherein

the modulation wave upper limit value calculation unit calculates the upper limit value of modulation wave so that the upper limit value of the modulation wave has an initial value, when an output frequency is 0;

increases monotonously from the initial value with increase of the output frequency;

is limited to an upper limit of a minimum pulse width when it exceeds the upper limit of the minimum pulse width required by a switching device; and

is changed so that it coincides with the maximum value of the carrier wave, when the output frequency becomes high.